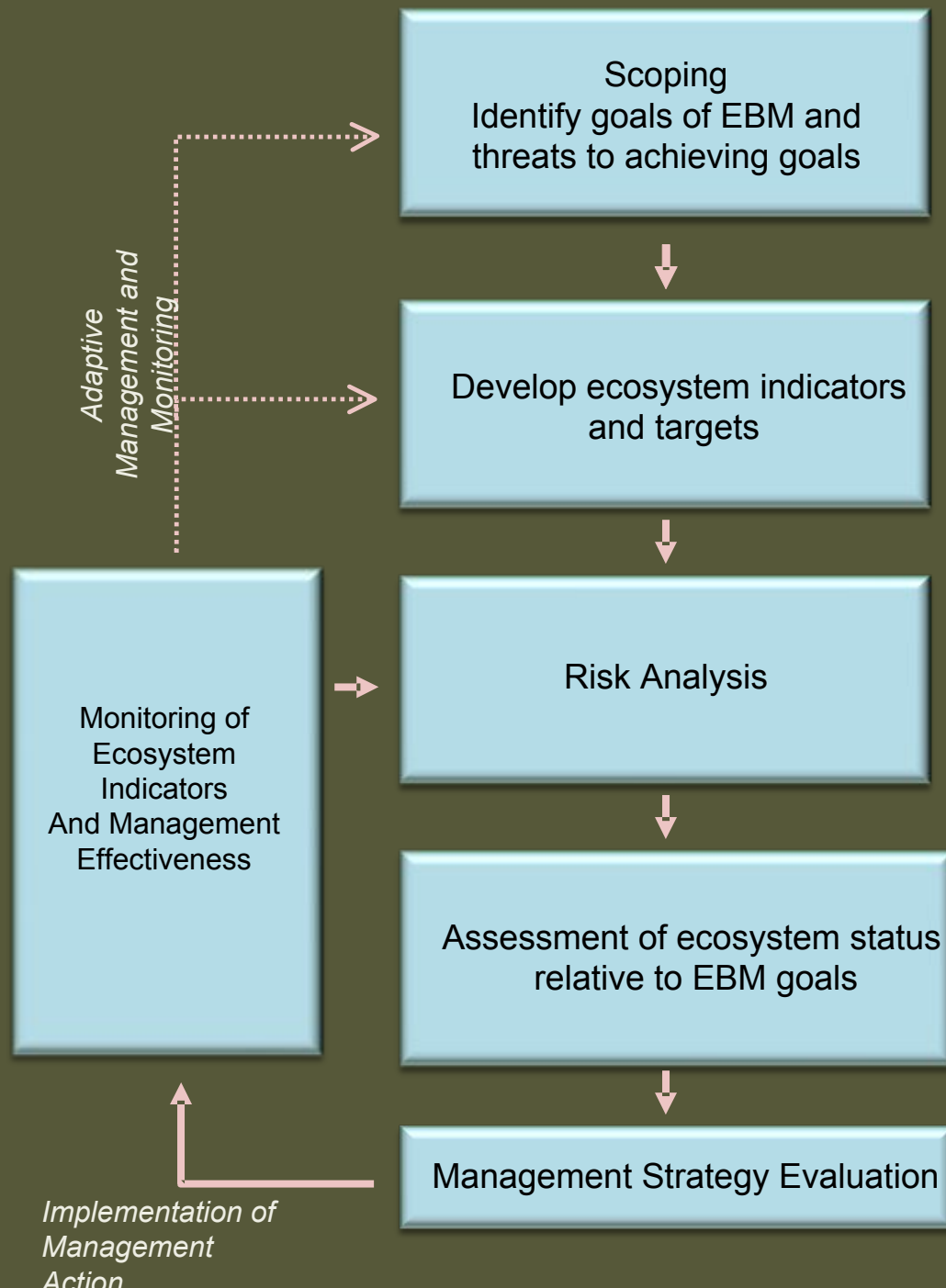


# What is an IEA?

---

An IEA is a synthesis and quantitative analysis of information on relevant physical, chemical, ecological and human processes in relation to specified ecosystem management objectives.

Identify multiple objectives, evaluate impacts of multiple strategies





# IEAS IN PUGET SOUND

Scoping

# Scoping the IEA--Puget Sound Partnership's common vision

1. What is a 'healthy' Puget Sound?
2. Where are we now, and what are the major threats or impediments to achieving a 'healthy' state?
3. What strategies are needed to achieve our goals?
4. Where should we start?





# IEAS IN PUGET SOUND

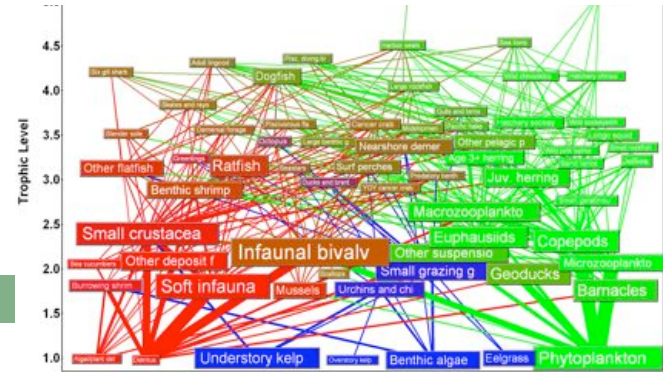
Indicators and thresholds (What is healthy?)

# Our quantitative approach for evaluating indicators for defining healthy

---

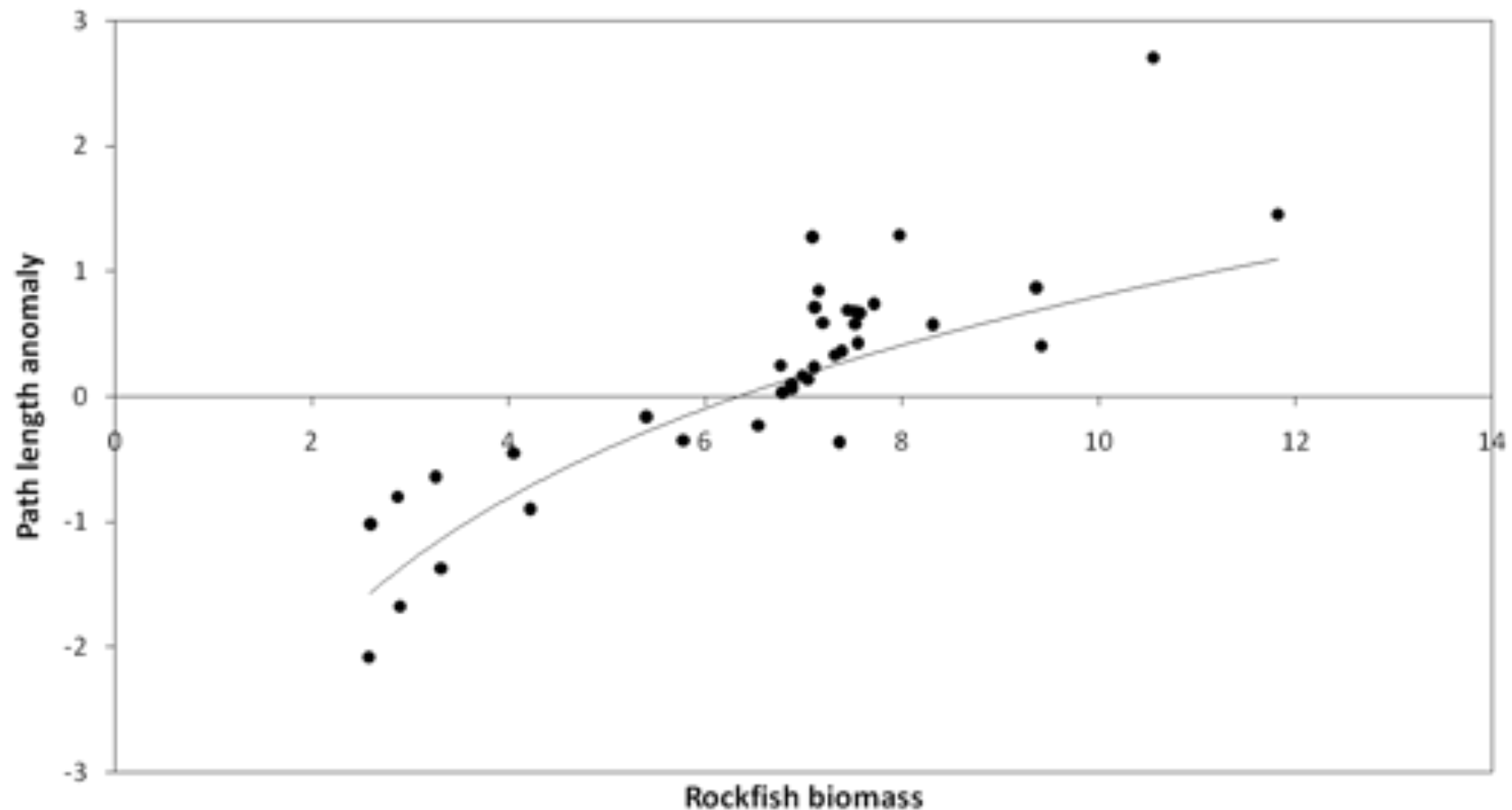
- ◆ Select **attributes** of interest
  - / E.g., biomass distribution, trophic structure, resilience
- ◆ Use **food web and /or ecosystem models** to examine correlations between ecosystem attributes and indicators of those attributes

# Approach



- ◆ We used 4 Ecopath with Ecosim (EwE) models to develop a database of values for marine ecosystem indicators and attributes.
- ◆ For each of the models, we simulated scenarios in which we altered mortality rates of a number of groups for the duration of 50 year simulations
- ◆ Examine the relationship between potential indicators and ecosystem attributes

# Rockfish are broad indicators: attribute: trophic structure





# Qualitative Approach to Indicators

---

- Identify, compile, and summarize former, current and proposed indicators for the Puget Sound ecosystem.
- Select and evaluate the most suitable ecosystem indicators based on established criteria.



# IEAS IN PUGET SOUND

Management Strategy Evaluation

# Management Strategy Evaluation: 3 examples

- ◆ Watershed restoration effects on stream flows and salmon (multiple strategies)
- ◆ Harvest impacts on marine food webs
- ◆ Nearshore restoration impacts on ecosystem benefits (multiple benefits)

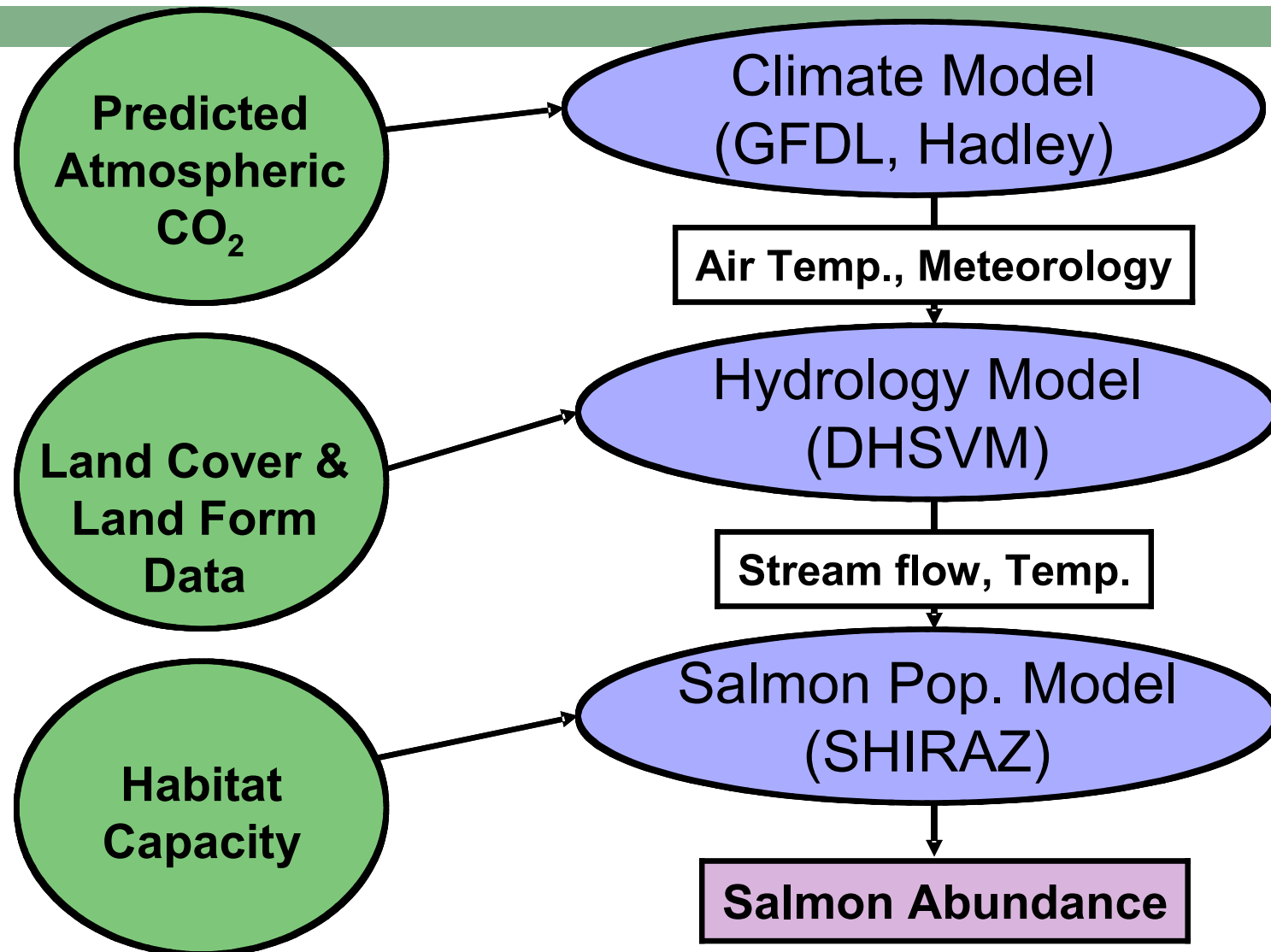




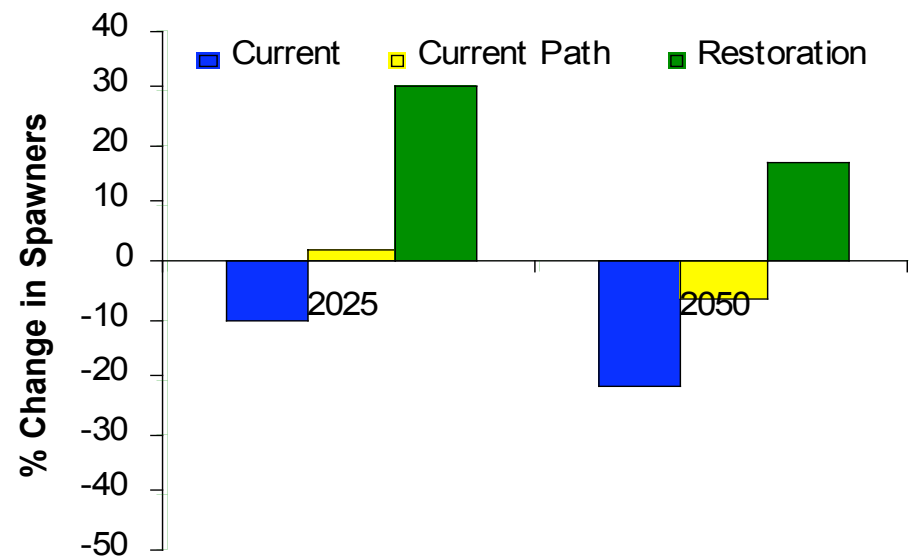
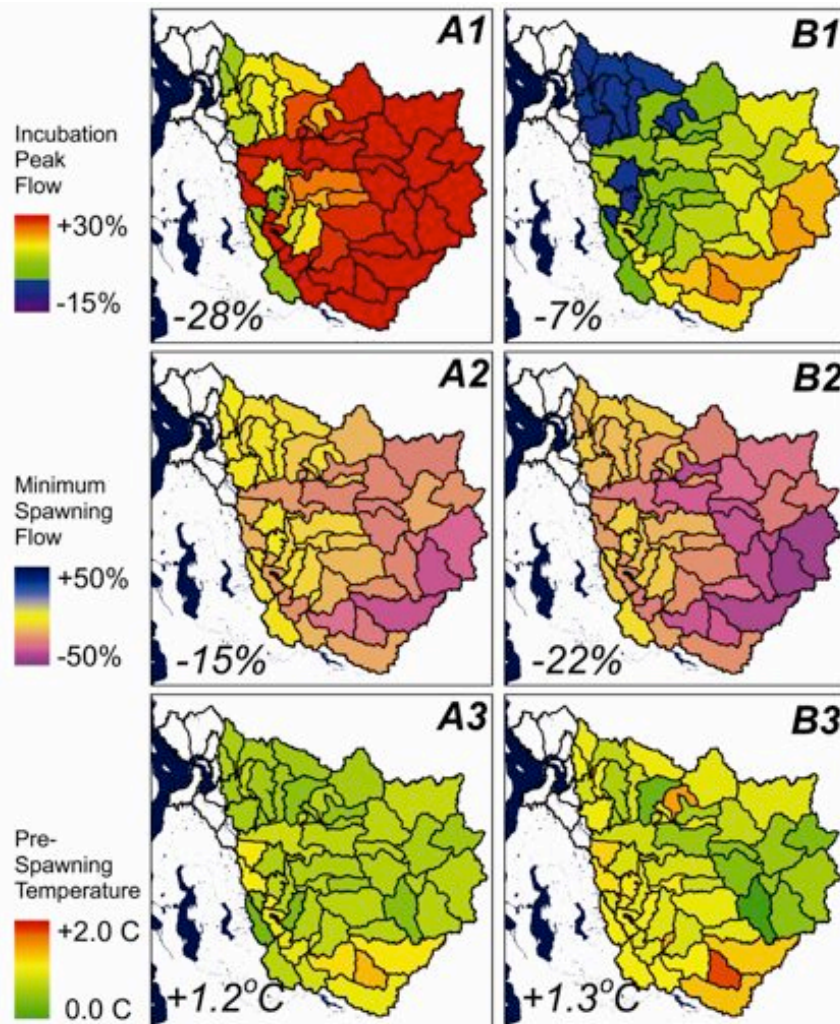
# Multiple strategies: Habitat, hatchery and harvest actions modeled for salmon recovery



# Evaluating recovery strategies with uncertain futures



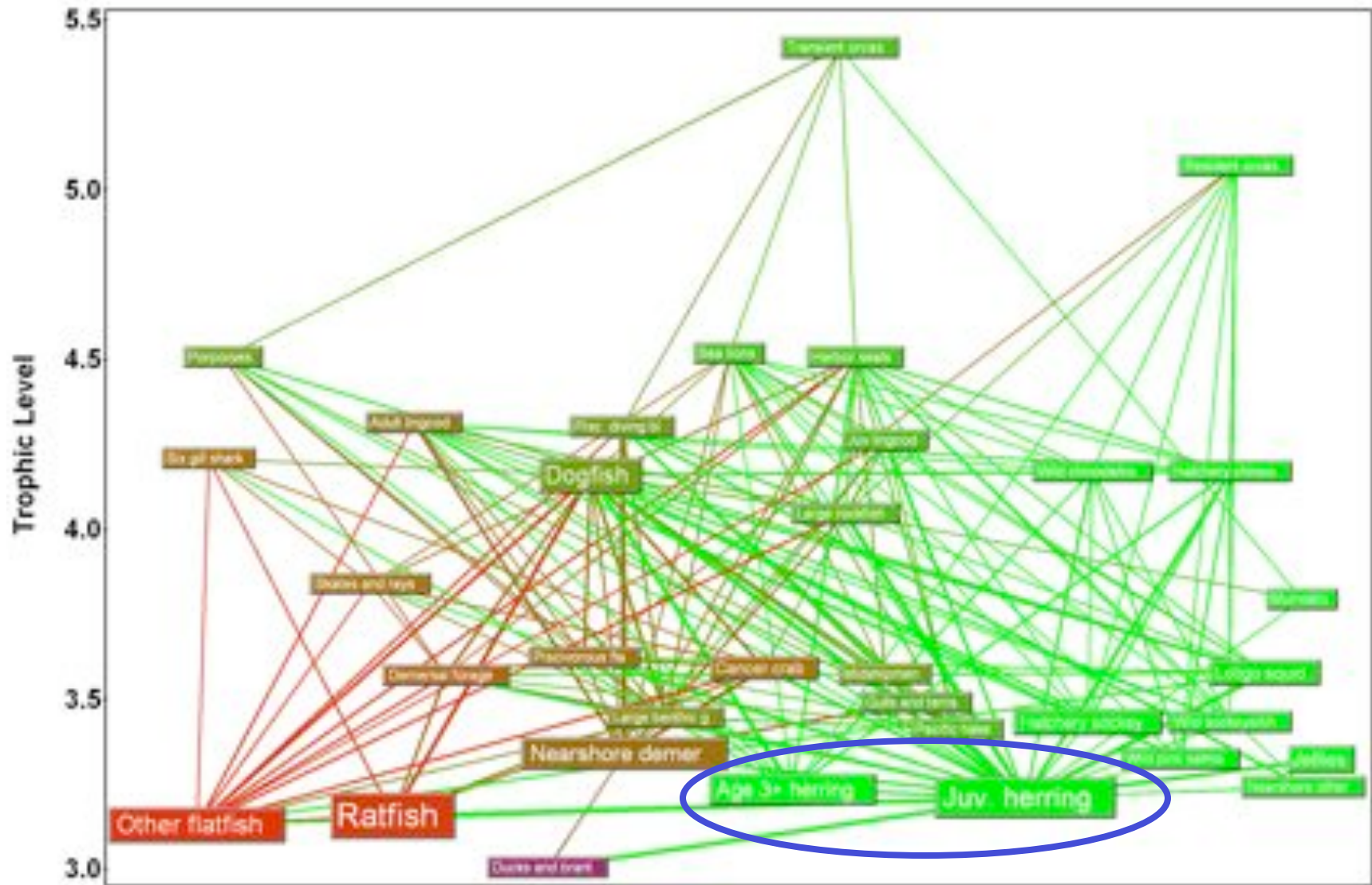
# Cumulative effects of restoration strategies: response of streams and salmon



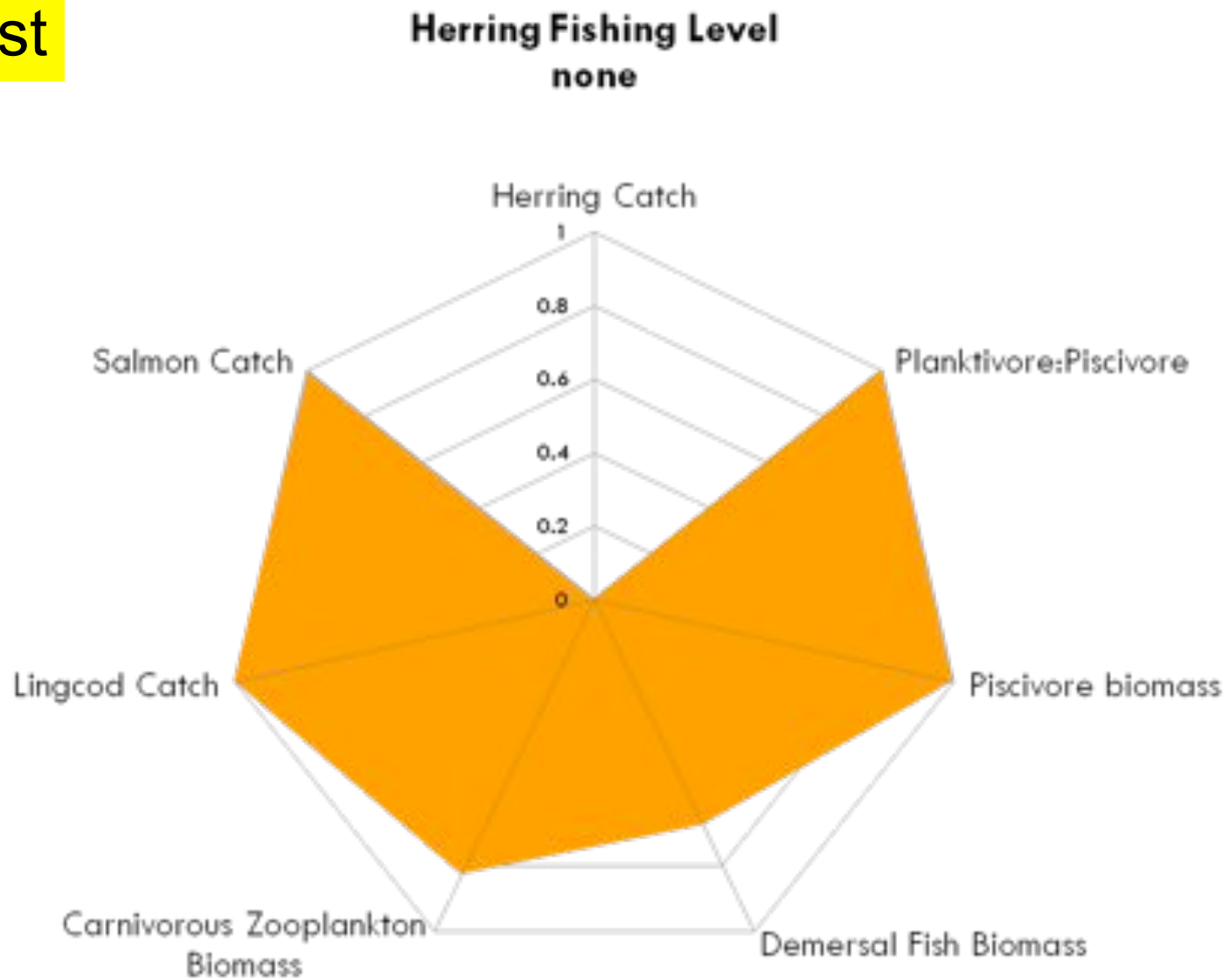
Battin et al. 2007



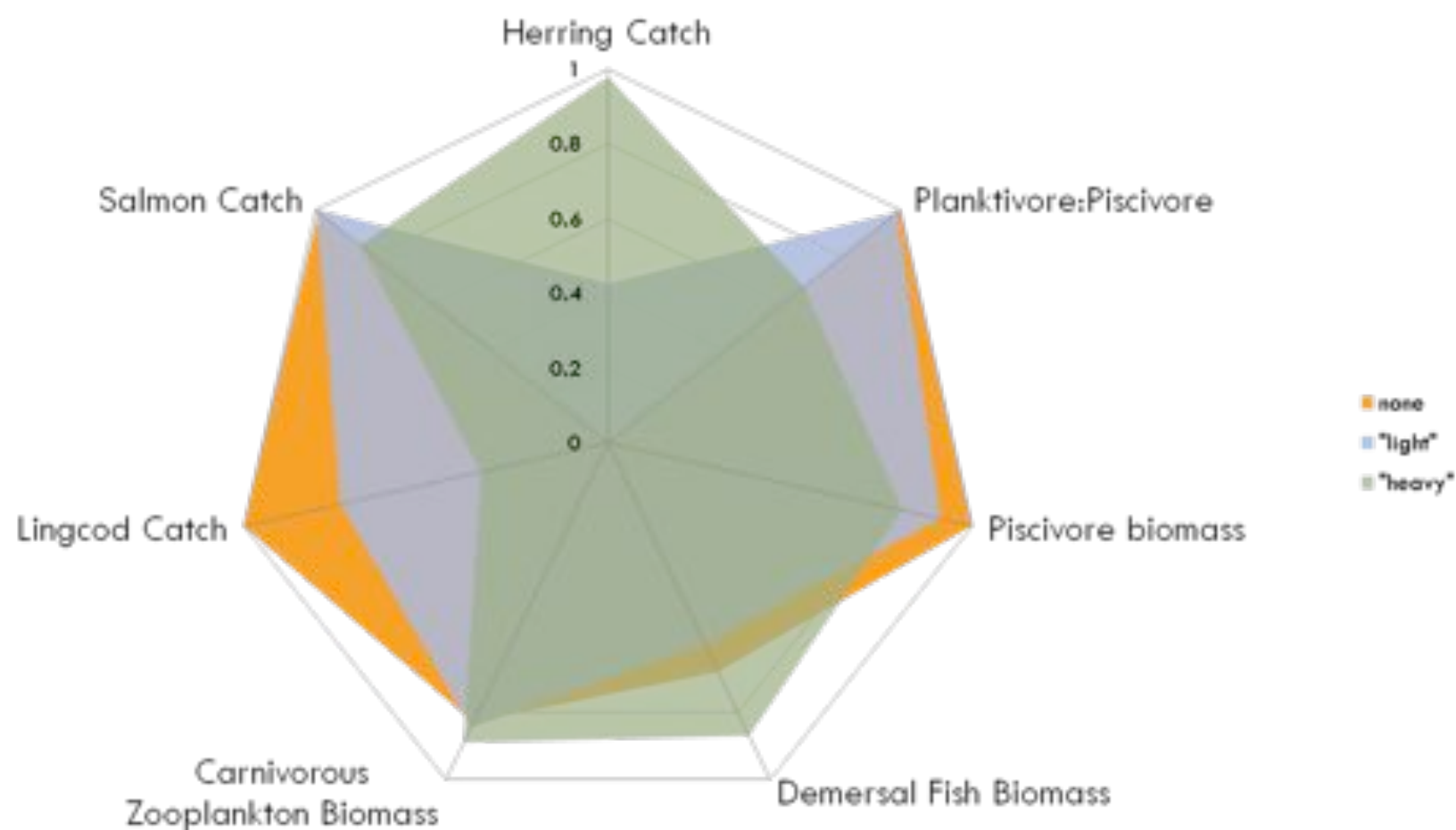
# Herring harvest impacts: food web context



# Harvest







# Management Strategy Evaluation: 3 examples

- ◆ Watershed restoration effects on stream flows and salmon (multiple strategies)
- ◆ Harvest impacts on marine food webs
- ◆ Nearshore restoration impacts on ecosystem benefits (multiple benefits)

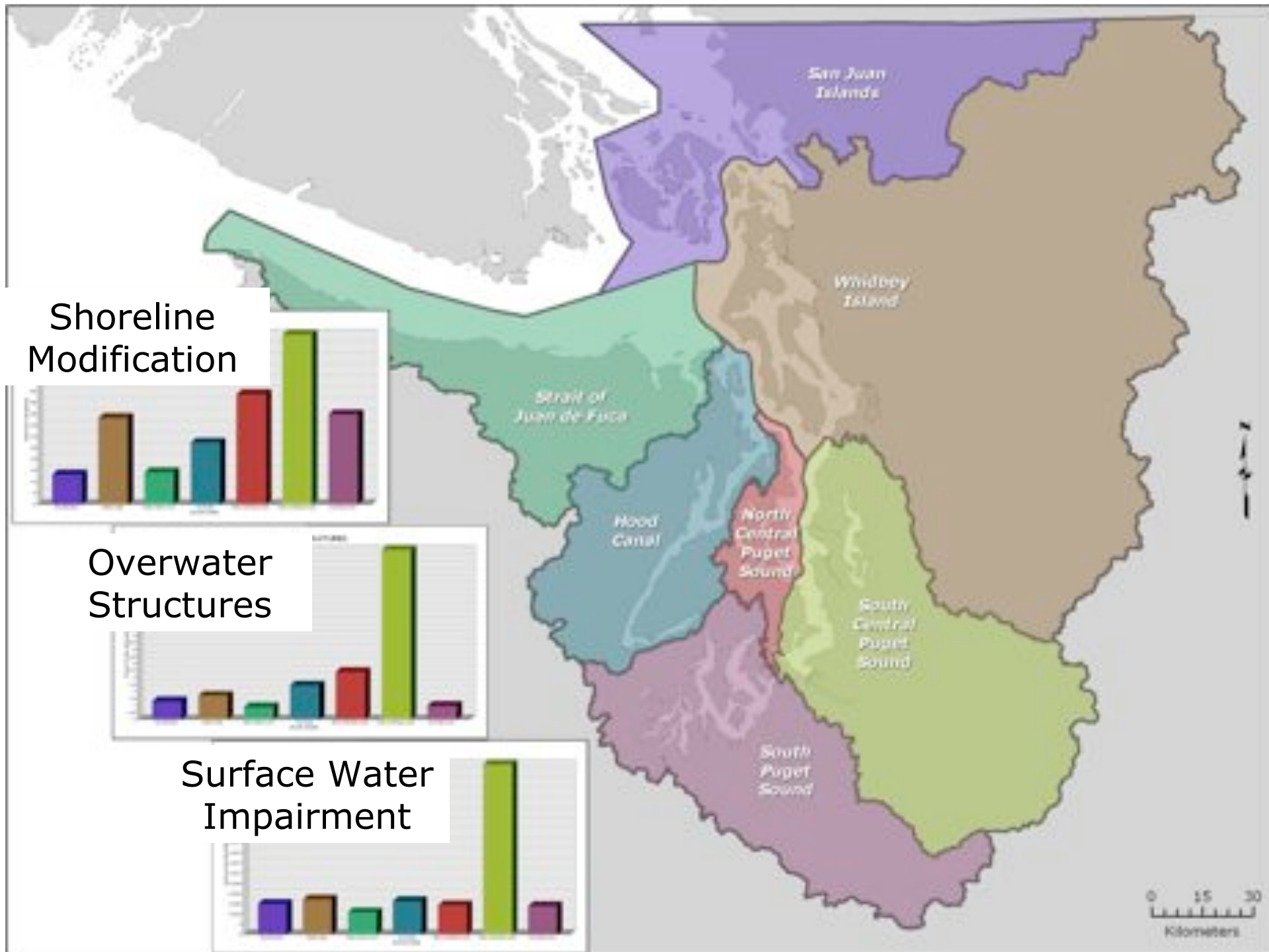


*What are the outcomes of nearshore degradation, protection or restoration for Puget Sound's ecosystem services?*

---



Jane Connelley



# Consequences of nearshore protection and restoration

Carbon sequestration

Marine harvest & food web support

Shoreline stabilization

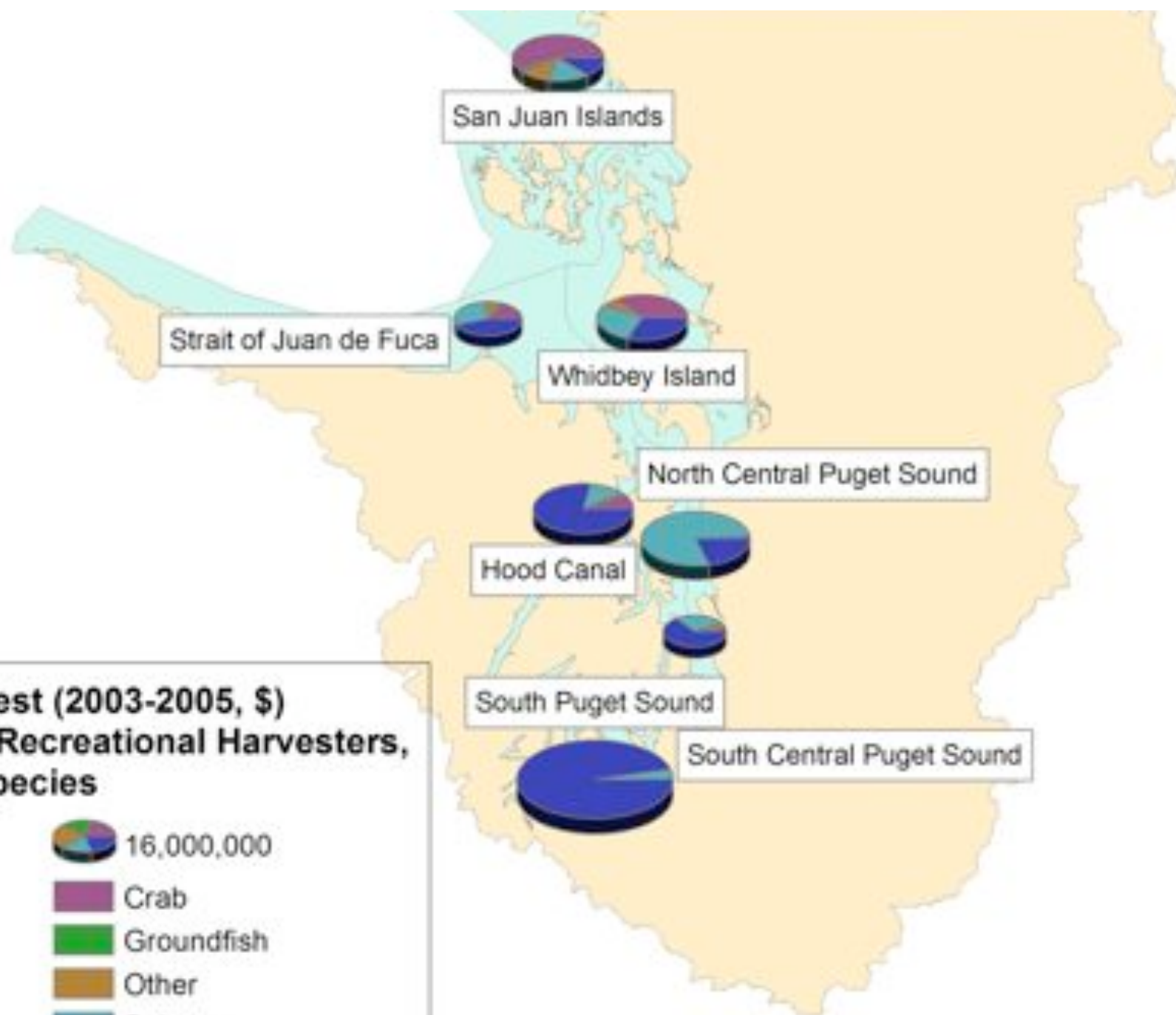
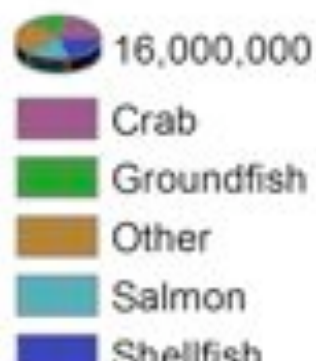
Phyto-remediation

Eco-tourism, recreation




Anne Guerry, Mark Plummer

**Harvest (2003-2005, \$)  
Non-Recreational Harvesters,  
All species**





# Linking ACT work & IEAs.....

- 
- A horizontal bar composed of two adjacent green rectangles. The left rectangle is a lighter shade of green, and the right rectangle is a darker shade of green.
- ◆ Building core process models (sea-floor mapping)
  - ◆ Sorting through cumulative impacts and net ecosystem benefits (climate, invasives, marine debris, habitat loss, pollution, alternative energy, sustainable communities, etc.)
  - ◆ Adapting (ocean awareness)





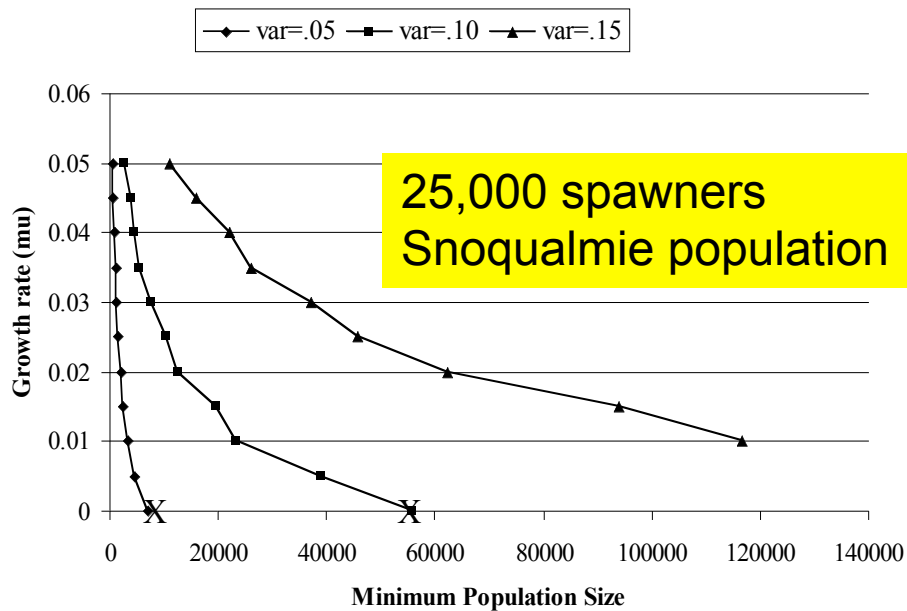
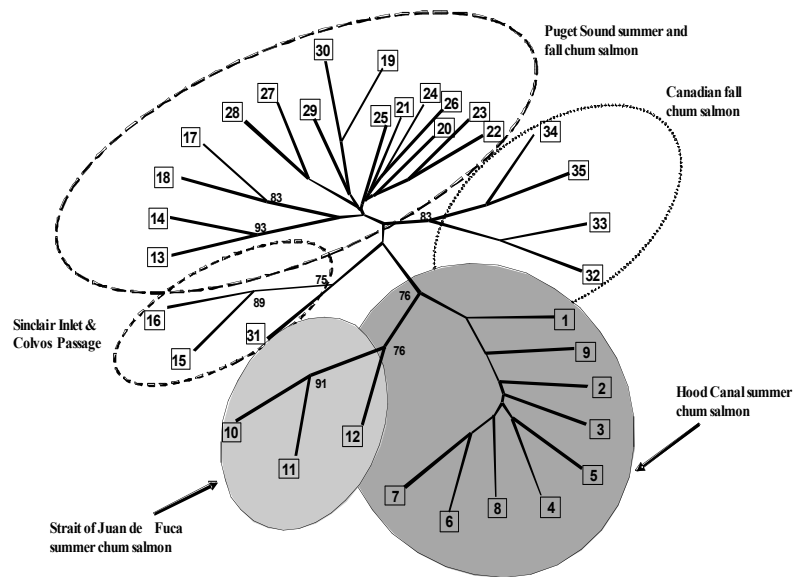


# IEAS IN PUGET SOUND

Risk Assessment and Ecosystem Status

(Current status? Major threats? How bad is it?)

# Salmon viability



Ruckelshaus et al. 2006

Using conceptual models, spatial threat analyses, and functional relationships to identify threats, potential solutions





Threshold: drinking water risk to humans is greatest in areas with agricultural land uses, in well depths < 45 m in glacial moraine deposits

